REMARKS

Claims 1-89 are now pending. Prior claims 1-82 were rejected. Claims 1, 5, 6, 9, 12, 14, 16, 20, 21, 24, 41, 43, 44, 55, 56, 61, 64, 65, 67, 68, 71, 72, 75, 76, 81, and 82 have been amended. Claims 83-89 have been added. No claims have been canceled. Re-examination and reconsideration of the pending claims are respectfully requested.

Information Disclosure Statement

An Information Disclosure Statement is being submitted with the present Amendment. Applicants request that acknowledgment of this additional IDS be included with the next communication regarding this application.

Formal Matters

Claims 16 and 82 have been amended to address the informalities identified in the Office Action of March 10, 2003. As these informalities have been corrected, removal of the formal claim objections to claims 16 and 82 is respectfully requested.

Claim Rejections under 35 U.S.C. § 102

Claims 65 and 66 were rejected under 35 U.S.C. § 102(e) as allegedly being anticipated by U.S. Patent No. 6,326,144 to Bawendi et al. Such a rejection is traversed in part and overcome in part as follows:

Independent claim 65 is directed to a method for sensing a plurality of intermingled labels. Method claim 65, as amended in the present application, recites identifying a first label by measuring a first discrete wavelength from among a plurality of predetermined discrete wavelengths <u>within a first wavelength range</u>. Claim 65 also recites identifying a second label by measuring a second discrete wavelength from among a plurality of predetermined discrete wavelengths <u>within a second wavelength range</u>. Claim 65 specifies that the first and second ranges are <u>separated</u>, and that the <u>discrete wavelengths</u> within each of the ranges are sufficiently <u>close</u> that two signal at adjacent discrete wavelengths within a range would substantially overlap. The use and advantages of such wavelength ranges or "windows"

can be understood with reference to figures 2A-4 and the associated text on page 24, line 32 through page 26, line 26 of the originally filed specification for this case.

As explained in the originally filed application for this invention, the use of a single isolated signal peak allows relatively simple identification of the peak frequency without having to resort to complex (and often error prone) overlapping signal deconvolution. While this allows identification of quite closely packed peak wavelengths, the totally number of codes in such a library may be limited. To increase the total number of separately identifiable labels, while maintaining many of the advantages of a single peak system, the present invention allows multiple separated peaks within "windows" or wavelength ranges such as those indicated by reference numerals 42a, 42b, 42c. . . in Fig. 3. Each of these allowable reference windows can be separated by a separation wavelength range 44, as shown in the example provided in Fig. 3. Discrete wavelengths 48 within each range can be quite close, so that if two signals were disposed at adjacent discrete wavelengths within a range, the signals would substantially overlap as shown by the dashed line of signal 40a in Fig. 3. Nonetheless, using <u>separated</u> signals within the allowed wavelength ranges allows reliable identification without complex deconvolution of overlapping signals.

Applicants note that pages 2 and 3 of the Office Action cite column 3, lines 44-59 of the Bawendi reference. This portion of the reference states:

> *The composition:target complex may be spectroscopically viewed by irradiation of the complex with an excitation light source. The quantum dot emits a characteristic emission spectrum which can be observed and measured spectrophotometrically.*
>
> *As an advantage of the composition of the present invention, the emission spectra of quantum dots have linewidths as narrow as 25-30 nm depending on the size heterogeneity of the sample, and lineshapes that are symmetric, gaussian or nearly gaussian with an absence of a tailing region. The combination of tunability, narrow linewidths, and symmetric emission spectra without a tailing region provides for high resolution of multiply-sized quantum dots within a*

> *system and enables researchers to examine simultaneously a variety of biological moieties tagged with QDs.* [U.S. Patent No. 6,326,144, Col. 3, lines 44-59]

Absent any explanation of how the above quote effectively discloses each and every element of claim 65, including the first and second wavelength ranges, the separation of the first and second ranges, and the use of discrete wavelengths within each range which are sufficiently close that signals at adjacent discrete wavelengths within a range would substantially overlap, anticipation of amended claim 65 has not been established. Therefore, Applicant respectfully requests that the rejections under §102 be removed, and that claims 65 and 66 be allowed.

Claim Rejections under 35 U.S.C. § 103

Claims 1, 10-12, 15-17, and (apparently) 18-21, 36-40, 41, and 72 have been rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over U.S. Patent No. 6,384,409 to Libbey III et al. in view of U.S. Patent No. 5,932,139 to Oshima et al. Such a rejection is traversed in part and overcome in part as follows.

Claim 1 now recites labels which generate wavelength/intensity spectra in response to excitation energy. Claim 1 further recites an analyzer which calibrates a wavelength or an intensity of the spectra using reference signals generated by reference markers of the labels. The use of reference signals for calibrating intensities of a wavelength/intensity spectrum can be understood with reference to Figs. 6A, 6B, 7, 8A, and 8B, along with the associated text of the originally filed specification for the present application. The use of reference signals from a reference marker of label for wavelength calibration of an intensity/wavelength spectrum can be understood with reference to Figs. 7, 8A, and 8B, along with the associated text of the originally filed specification. Applicants respectfully submit that no reference has been shown to teach or even remotely suggest the use of reference markers within each of a plurality of wavelength/intensity spectra for calibration of those spectra, as is now claimed by claim 1.

As can be understood from the disclosure throughout the application filed for the present invention, and (for example) as illustrated in Figs. 6A and B, when multiple intensities

are used within a wavelength/intensity spectral code, codes having different absolute intensity values (for example 1:3 and 2:6) may be difficult to accurately distinguish. To overcome this ambiguity, the present invention allows (for example) scaling or calibrating of the intensities of other signals based on an intensity of a reference signal, thereby facilitating unambiguous decoding of spectral codes having a plurality of intensities. Similarly, where a wavelength of the reference signal is known, that known wavelength may be used to accurately identify other wavelengths within a spectral code, as can be understood (for example) with reference to Figs. 8A and 8B.

Applicants fail to see any remote suggestion for the calibration of wavelengths or intensity of a wavelength/intensity spectrum as recited by independent claim 1. As Applicant understands the Libbey and Oshima references, these documents merely disclose fluorescent inks for writing information on a surface. The information of these known fluorescent ink systems depends on where the ink is located on the surface. Hence, the Libbey and Oshima systems suffer from significant disadvantages when tracking fluids or very small elements. For example, it can be difficult to write the required amount of code information on a liquid or microscopic particle.

The Examiner appears to acknowledge that Libbey does not teach or suggest the use of reference markers for calibrating spectra. Applicants note that Oshima uses reference markers solely for calibrating the time (and hence the associated surface area location) of the written code described in that specification. Hence, Oshima does not calibrate wavelength/intensity spectra such as those recited by independent claim 1. As no reference now of record teaches or suggests the use of reference markers for calibrating a wavelength or intensity of a wavelength/intensity spectra, independent claim 1 is allowable over of the cited art.

Rather than having to interpret a code based on the area where ink is placed upon a surface, the analyzer of claim 1 of the present invention identifies the elements using a calibrated wavelength/intensity spectra such as those illustrated in Figs. 6A, 6B, 7, 8A, and 8B. The information in the various signals making up the spectra is not limited by the available surface area, and the use of calibration to unambiguously and accurately identify wavelengths

or intensities of such wavelength/intensity spectra provides significant advantages, but has not been shown to be taught in or suggested by the cited art. Hence, independent claim 1 is allowable over the cited references.

Regarding dependent claims 10 and 11, the use of reference signals having a common reference wavelength significantly facilitates (for example) measurement of other wavelengths of other signals within a label, as it allows those other wavelengths to be measured relative to a single starting point. Such a common reference wavelength for calibration of other wavelengths or intensities is not remotely taught or suggested by the cited Libbey or Oshima references.

Regarding independent claim 12, the advantages of using a shortest or longest wavelength of the wavelength/intensity spectra of the label as a reference wavelength can be understood, for example, with reference to Fig. 6B. Here, the longest wavelength of each spectra is used as a reference signal. As this reference signal is known to have relative intensity of "one," the other intensities of each spectra may be determined relative to this easily identified reference. As the Libbey and Oshima references fail to provide such advantages and do not teach or disclose the system recited in claim 12, the claim is allowable.

Regarding independent claim 20, that claim recites a method for sensing a plurality of identifiable elements. Claim 20 recites labeling each identifiable element with a <u>reference marker</u> and at least one associated other marker, and measuring a wavelength/intensity spectrum. A first identifiable element is identified by <u>calibrating a wavelength of the spectrum</u> with reference to a reference wavelength of a reference signal <u>from the reference marker</u>. As no prior art reference has been shown to even remotely describe or suggest the calibration of a reference wavelength within a wavelength/intensity spectrum, claim 20 is now in condition for allowance.

Regarding independent claim 21, that claim also recites labels generating wavelength/intensity spectra in which each wavelength/intensity spectrum includes a spectral calibration reference signal from a reference marker. Hence, independent claim 21 is allowable for many of the reasons given above.

Regarding the inventory labeling generating method recited in independent claim 72, Applicant notes that the originally filed specification provides significant details on exemplary methods for generating acceptable spectral codes beginning on page 32, line 23 (for example). Claim 72 recites that candidate labels are generated, and that acceptably distinguishable labels are selected from among the candidate labels by determining wavelength/intensity spectra emitted by the candidate labels. The labels of the Libbey and Oshima references are simply printed onto a solid surface, and Applicants see no teaching or suggestion that distinguishable codes be selected from candidate printed codes, much less for the selecting from among candidate labels by determining wavelength/intensity spectra as recited by claim 72. Hence, claim 72 is allowable over the cited art.

Claims 2-4, and apparently claims 22, 23, 42, and 73 were rejected under §103(a) as allegedly being unpatentable over Libby and Oshima in view of U.S. Patent No. 6,236,104 to McGrew. Applicant notes that the McGrew reference is directed to a method and apparatus for reading and verifying <u>holograms</u> (rather than the inventory and identification techniques of the pending claims) and that McGrew is cited for the proposition that the use of nanocrystals or quantum dots <u>in fluorescent inks</u> is known. As the Examiner does not allege that the McGrew reference teaches or discloses the use of Quantum Dot (or any other structure) as a reference marker within a label generating identifiable wavelength/intensity spectra, claims 2-4 are allowable for the reasons given above regarding claim 1. In fact, any suggestion in the McGrew reference that nanocrystals be used in fluorescent inks is largely irrelevant to (and certainly does not remotely suggest) the use semiconductor nanocrystals in labels for identification by an analyzer from the <u>wavelength/intensity</u> spectra of the labels. Hence, claims 2-4 remain in condition for allowance. Similarly, claims 22 and 23 are allowable as depending from allowable base claim 21, and for reciting the advantageous use of semiconductor nanocrystals in the novel library of elements recited by that independent claim.

Regarding dependent claim 42, that claim depends from claim 41. As noted above, claim 41 recites "windowing" methods which include selecting from among a plurality of discrete predetermined wavelengths so as to determine a wavelength of a first signal within a

wavelength range or "window." Claim 42 further recites the use semiconductor nanocrystals generating at least some of the signals. As semiconductor nanocrystals allow signal peaks to be generated at discrete, closely-spaced wavelengths, they provide significant advantages when used within the method of claim 41. However, as the Office Action fails to show where McGrew teaches or suggests the highly advantageous use of semiconductor nanocrystals within a wavelength range "windowing" methods such as that cited by claim 41, *prima facie* obviousness of claim 42 has not been established. Similarly, regarding dependent claim 73, the Office Action fails to establish that the McGrew reference teaches or suggests the combination of the use of semiconductor nanocrystals with the advantageous label-generating method recited therein. Hence, *prima facie* obviousness of claim 72 and/or 73 has not been established.

Claims 5-9, and apparently claims 13, 14, 24-35, 43-64, 67-71, and 74-82 were rejected under §103(a) as allegedly being unpatentable over Libbey, Oshima, and McGrew in view of U.S. Patent No. 3,663,813 to Shaw. Applicant notes that the Office Action cites Shaw as disclosing a spectral coding system using different wavelengths and different intensities, and that the use of different wavelengths and different intensities allows for a increase number of identifiable codes. However, as described in the originally filed application for the present invention, the use of a first code (at, for example, an intensity ratio of 1:3) and a second code having a similar relative intensity ratio but different absolute intensities (for example, having intensity ratios of 2:6) can result in ambiguity when attempting to accurately identify the codes. Furthermore, unlike the simple 4-wavelength system of Shaw, the application for the present invention may make use of a very large number of tightly spaced spectral peaks, which benefit significantly from a reference signal for <u>wavelength</u> calibration. The Shaw reference fails to recognize the ambiguity of spectral codes having similar ratios but different absolute values, and uses only a few widely spaced signal labelings, so that the reference signals of independent claim 1 have not been shown in the cited art. Similarly, the use of windowing, or identification of discrete wavelengths within a wavelength range, is nowhere to be found in the Shaw reference. Hence, the independent claims are allowable over the Shaw reference for the reasons given above.

Regarding dependent claim 5, that claim now clearly recites the use of both reference semiconductor nanocrystals and other semiconductor nanocrystals mixed together in spatially integrated labels. The Libbey, Oshima, and McGrew references are inapposite regarding the claimed spatially integrated semiconductor nanocrystal labels, as none of those references even remotely teach or suggest the wavelength/intensity spectra identification system now being claimed. The Shaw reference states at the top of column 1 that the presence of two different levels or concentrations of components provides symbols numbering 3^n-1, in which "n" designates the number of components. Assuming there are two components, Shaw therefore teaches such a system would allow 3^2-1=8 different symbols to be represented. Given three different quantities (0, 1, or 2) of two different components ("A" and "B"), these 8 symbols might include:

	0A:1B	0A:2B
1A:0B	**1A:1B**	**1A:2B**
2A:0B	**2A:1B**	2A:2B

Unfortunately, Shaw fails to recognize that many of these potential symbols are ambiguous. Specifically, as explained above and with reference to Figs. 6A and 6B in the specification originally filed for the present invention, many of these purported symbols are ambiguous, as it can be quite difficult to determine whether the intended code is a 1:1 symbol or a 2:2 symbol. Similarly, it can be difficult to determine whether the intended code is a 1:0 or a 2:0 symbol. As a result, there may really only be as few as 4 unambiguous codes in such a system, as shown by the bold entries in the above table. The present invention overcomes this ambiguity by providing a robust code having a reference signal for calibrating wavelengths and/or intensity of the overall spectrum, thereby providing significant advantages over the system described in Shaw. As the recited reference signals have not been remotely shown in the cited art, independent claim 1, and dependent claims 5-9 are allowable over the cited art.

Regarding claim 6, Applicants note that the Examiner appears to agree that the Oshima reference describes a spatial code in which signal duration varies relative to a reference

signal duration. The signal duration variation in Oshima results from differing rates of scanning across the spatial bar code described in the Oshima patent. Such spatial variation are absent from the Shaw reference, and the cited art fails to recognize any need for calibration of a spectral bar code, much less describe any reference marker suitable for use in such calibration. As the cited art does not reasonably teach or suggest the tremendous advantages provided by the invention recited in the current claims, Applicant respectfully requests that the rejections be removed and that the claims be allowed. Claims 7 and 8 depend from claim 6, and are allowable as depending from an allowable base claim, as well as for the novel combinations of elements recited therein.

Regarding claim 9, that claim depends from claim 7 and further recites that the reference signal has a highest or lowest intensity of the wavelength/intensity spectra, or a shortest or longest wavelength of the wavelength/intensity spectra. As can be understood with reference to the description given above and the originally filed specification for this case, the use of a reference signal which is readily identified as having an intensity or wavelength which stands out from among the other signals of the spectra greatly facilitates calibrating of the other signal intensities or wavelengths. As this important advantage has not been addressed and the relevant structure has not been shown to be obvious in light of any teaching in any of the cited references, nor as being within the general knowledge of those of ordinary skill in the art, *prima facie* obviousness of claim 9 has not been established.

Regarding claim 13, that claim recites reference signals having reference wavelengths, along with other signals having other wavelengths which are discretely quantifiable by reference to the reference wavelength. The references cited against this claim appear to be entirely devoid of any teaching or suggestion of any wavelength calibration whatsoever, so that obviousness of claim 13 has not been shown. Claim 14 is allowable for the reasons given above regarding claim 1, as well as for the novel combination of elements recited therein.

Regarding claims 24-35, those claims are allowable for many of the reasons given above regarding claims 5-14, and as depending from allowable independent claim 21. As an example, claim 24 recites a library of elements including a plurality of identifiable elements

in which each identifiable element is labeled with a label including at least one reference semiconductor nanocrystals, and in which at least some of the labels include other semiconductor nanocrystals. The reference semiconductor nanocrystals are mixed with the other semiconductor nanocrystals in the at least some labels. Once again, no reference now of record reasonably teaches or suggests the use of a mixture of reference semiconductor nanocrystals with other semiconductor nanocrystals in labels so as to generate identifiable wavelength/intensity spectra. Hence, claim 24 is allowable over the cited references.

Regarding claims 43-64, Applicant respectfully disagrees with the Examiner's assertion that these method claims are obvious variations of the systems recited by claim 1, 5, and 6, and/or of the systems recited by claims 1, 5, 6, 10, 11, and 14. As discussed above, independent claim 41 is directed to a wavelength windowing system, as opposed to the use of reference markers generating reference signals. As an example of the differences between the claims which depend from claim 41 and those based on the other independent claims, claim 46 specifies that discrete wavelengths within each range are sufficiently close so that <u>two signals at adjacent discrete wavelengths within the range would substantially overlap</u>. As the Office Action fails to even remotely address the use of potentially overlapping discrete signal wavelengths within a wavelength/intensity spectrum, much less the windowing system recited by independent claim 41, Applicant respectfully requests that the rejections of these claims be removed, and that the claims be allowed.

Regarding claims 67-71, Applicants again note that the inventory systems recited by these claims are <u>not</u> the same as or suggested by the system of claims 1, 2, 6, and 17, as the elements recited by the claims have not bee addressed in an Office Action, Applicant respectfully requests that the current rejections of these claims be removed, and that the claims be allowed. Similarly, the method for generating inventory labels recited by dependent claim 74-80 have not bee addressed in an Office Action, so that neither anticipation nor obviousness of the combination of elements recited by these pending claims have been established.

The Added Claims

Applicant has added new claims 83-89 to more fully claim the present invention. Claims 83-88 depend from either claims 1 or 20, and recite (for example) the use of spatially intermingled markers and mixed quantum dots, which is generally contrary to the fluorescent ink printed labels of the Oshima et al., Libbey et al., and similar references. Independent claim 89 is similar in many aspects to prior claim 41, reciting the advantageous use of tightly-spaced discrete signal frequencies within acceptable signal wavelength ranges. As such elements have not been shown to be taught or suggested in the cited art, the added claims are no in condition for allowance.

CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 650-326-2400.

Respectfully submitted,

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